Description

Method and arrangement for real-time transmission of compressed data

The invention relates to a method and an arrangement for real-time transmission of compressed data.

The transmission of compressed data in the field of telecommunications is usually effected on line-connected connections. Thus, by way of example, video data are generated in the course of a video conference or during video telephony by ISDN terminals (Integrated Services Digital Network) and are transmitted in real time exclusively via circuit-switched connections of an ISDN fixed network with a constant data rate, i.e. on one or two 64 kbit/s paths. Depending on the motion of the objects in the recorded picture, the coding device responsible for the data compression generates data streams with greatly varying data rates. For transmission in the ISDN fixed network, the data streams - with the varying data rates - are brought to the respective constant data rate by the suitable addition of filling data (bit stuffing) to the compressed video data. Real-time transmission of the compressed data, that have been conditioned with filling data, into a communications network with data streams with a variable data rate, (e.g. a mobile communications network with a radio interface), is uneconomical since the precious transmission bandwidth available on the radio interface must be utilized as efficiently as possible with regard to useful data transmission.

The object of the invention is to specify a method and an arrangement by means of which it is possible to obtain economical real-time transmission of compressed data from one communications network to another communications network.

This object is achieved according to the invention by means of the features

of patent claim 1 with regard to the method, and by means of the features of patent claim 6 with regard to the arrangement. Developments of the invention can be gathered from the subclaims.

~~According~~ Thus, to the present ~~subject matter of the~~ invention, useful data and filling data are received as a data stream with a constant data rate via a circuit-switched connection of a first communications network. The ~~The~~ filling data contained in the data stream with the constant data rate is then ~~are~~ removed, and the useful data contained in the data stream with the constant data rate is ~~are~~ reformatted and sent as a data stream with a variable data rate via a packet-oriented connection of a second communications network. An ~~The~~ advantage of the present invention lies ~~consists~~ in the efficient utilization of the transmission bandwidth by the removal of the superfluous filling data which is ~~are~~ received in the data stream with the constant data rate via the circuit-switched connection, and the reformatting of the useful data for the data stream with the variable data rate via the packet-oriented connection. This has an particularly ~~especially~~ favorable effect if the real-time transmission of the compressed data leads into a mobile communications network with a radio interface which is limited in terms of transmission bandwidth. Instead of the sorted-out filling data, useful data is ~~are~~ transmitted in accordance with the variable transmission bandwidth available for the subscriber connection, i.e. ~~also~~ in data streams with higher data rates.

According to an embodiment ~~a development~~ of the present invention, quality data for identifying the transmission quality of the packet-oriented connection is ~~are~~ communicated to the second communications network. The effect achieved as a result of this is that in the second communications network there is uniformly good transmission of the compressed data - exclusively useful data - in comparison with the transmission quality of the first communications network.

Preferably, an average data rate and/or a maximum data rate for the data stream with the variable data rate ~~are~~ is determined

as quality data. Setting the average data rate and/or the maximum data rate makes it possible to obtain an acceptable reproduction quality of the compressed useful data at the receiver since the real-time transmission allows only very short delay times, e.g. in the milliseconds range.

In accordance with a further ~~preferred~~ embodiment ~~refinement~~ of the present invention, the quality factor of the transmission channel used for the data stream with the variable data rate - detectable from the permissible bit error rate - is used for identifying the transmission quality.

The present invention has ~~proved~~ proven to be particularly favorable with regard to economical and efficient utilization of radio resources if compressed video data ~~are~~ is received as the data stream with the constant data rates via the circuit-switched connection of a line-connected communications network, ~~and are~~ sent as the data stream with the variable data rate via the packet-oriented connection of a mobile communications network.

The arrangement according to the subject matter of the invention has a device, having

- means for receiving useful data and filling data which arrive as a data stream with a constant data rate via a circuit-switched connection of a first communications network,
- means for removing the filling data contained in the data stream with the constant data rate and for reformatting the useful data contained in the data stream with the constant data rate,
- means for sending the reformatted useful data as a data stream with a variable data rate via a packet-oriented connection of a second communications network.

The invention is explained in more detail below using an exemplary embodiment with reference to a figure which

shows an arrangement for real-time transmission of compressed data between a first communications network and a second communications network.

In the present example, it shall be assumed that the first communications network is formed by a fixed network ISDN (Integrated Services Digital Network) and the second communications network is formed by a mobile communications network UMTS (Universal Mobile Telecommunication System). Furthermore, it shall be assumed that a device SSU having the features ~~according to~~ of the present invention for real-time transmission of the compressed data from the fixed network ISDN to the mobile communications network UMTS is arranged as an autonomous device between the two communications networks. ~~Equally, it~~ could also be part of either the fixed network ISDN or ~~of~~ the mobile communications network UMTS. Furthermore, the present invention is not restricted to the exemplary communications networks ISDN, UMTS but rather can be applied to other communications networks as well. The fixed network ISDN and the mobile communications network UMTS each have a control device NC and RNC, respectively, which, on the network side, forms the interface to the device SSU for the data transmission. If the device SSU is part of the fixed network ISDN or ~~of~~ the mobile communications network UMTS, it ~~would~~ would preferably be arranged in the control device NC or RNC, respectively. Each control device RNC, NC has both a control unit RST, ST and ~~also~~ a storage unit RSP, SP. The device SSU ~~is~~ likewise is provided with a control unit CTR, to which there are connected a receiving unit RC at the interface to the control device NC and a sending unit TR at the interface to the control device RNC.

The compressed data ~~are~~ is, by way of example, compressed video data which ~~are~~ is generated by a video coder as a data stream DS1 with a constant data rate DRk - for example 64 kbit/s or 2*64 kbit/s - and ~~are~~ is transmitted via at least one circuit-switched connection of the fixed network ISDN. In this case, the constant data rate DRk is generated

by the addition of filling data F to useful data N (bit stuffing). The useful data N contains the data which is necessary for the video conference, is generated by a communications terminal of the line-connected fixed network ISDN and is transported in real time to a communications terminal of the mobile communications network UMTS. In order to enable efficient and economical utilization of the radio resources - in particular of the radio interface which is limited in terms of transmission bandwidth - during the real-time transmission of the compressed video data even in the mobile communications network UMTS, the device SSU converts the received data stream DS1 with the constant data rate DRk into a data stream DS2 with a variable data rate DRv. The receiving unit RC receives the filling data F and useful data N arriving via the circuit-switched connection. The control unit CTR detects and removes the filling data F from the data stream DS1 and reformats only the remaining useful data N to form a data stream DS2 with a variable data rate DRv. The sending unit TR sends only useful data N in the conditioned data stream DS2 with the variable data rate DRv via a packet-oriented connection of the mobile communications network UMTS. The reformatting is effected by embedding the useful data N (i.e., the video data) into the transmission format of, for example, a packet-oriented GPRS service (General Packet Radio Service) or of the packet-oriented ATM (Asynchronous Transfer Mode) cells. In this way, the data gap produced by the filling data F, in the data stream DS1 with the constant data rate DRk, can be utilized for the transmission of further video data or other useful data N in the data stream DS1 with the variable data rate DRv.

The control unit CTR of the device SSU determines quality data QoS (Quality of Service) for identifying the transmission quality of the packet-oriented connection and communicates them to the control device RNC of the mobile communications network

UMTS via the sending unit TR. The effect achieved as a result of this is that in the second communications network UMTS

uniformly good transmission of the compressed data, which is exclusively useful data N in the data stream DS2 with the variable data rate DRv, prevails in comparison with the transmission quality of the first communications network ISDN. The quality data QoS include, for example, the specification of the quality factor of the transmission channel used for the data stream DS2 in the mobile communications network UMTS, detectable from the permissible bit error rate. The real-time requirements made of the transmission of the video data by ~~means of~~ a package-oriented method in the mobile communications network UMTS are reflected in an average data rate and/or a maximum data rate which are determined as quality data QoS for the data stream with the variable data rate. Setting the average data rate and/or the maximum data rate makes it possible to obtain an acceptable reproduction quality of the compressed video data at the receiver, since the real-time transmission allows only very short delay times, e.g. in the milliseconds range.

The maximum data rate corresponds to the total data rate in the fixed network ISDN, which results from a plurality of individual data rates which are used during transmission of the video data stream via a plurality of circuit-switched connections. For the example of the two 64 kbit/s transmission paths, the total data rate is 128 kbit/s. The average data rate is characterized by the volume of data which is generated by the video coder within a defined period of time during a typical video conference. Preferably, this ~~said~~ average data rate is determined empirically on the basis of a point-to-point video conference (i.e., little to no ~~un~~moving background, no particular lip movements nor gestures and facial expressions of the subscriber) and made available as a configurable parameter to the control unit CTR of the device SSU. With the use of a codec according to the ITU-T H. 263 Standard and an unmoving background, the average data rate of a point-to-point video conference is, by way of example, about 10 kbit/s for the QCIF picture format and 176*144 pixels.